WE CLAIM:

1. A scanning beam optical imaging system for macroscopic imaging of an object, said system comprising:
   a) an illumination source producing a light beam directed upon an optical path toward said object;
   b) a scan lens having an external entrance pupil, for focusing said light beam to a diffraction-limited configuration in a prescribed object plane;
   c) a scanner for scanning said light beam to move said diffraction-limited configuration in a pre-determined scan pattern on said object plane;
   d) said scan lens being a liquid immersion scan lens with an immersion liquid filling a space between said scan lens and said object;
   e) a detector located to receive light from said object plane and a display to produce a signal from said detector.

2. An imaging system as claimed in Claim 1 when said system is a confocal imaging system and there is a detection arm located between said object and said detector, said detection arm receiving light from said diffraction-limited configuration in said object plane, said detection arm having a pinhole and a focusing lens to obtain a focal point for confocal detection of said light returning from said object, said detector being located behind said pinhole, there being a beamsplitter located between said detection arm and said object, said beamsplitter directing light returning from said object into said detection arm.

3. An imaging system as claimed in Claim 1 wherein said system is a non-confocal imaging system and there is a detection arm located between said detector and said object, said detection

arm receiving light from said diffraction-limited configuration in said object plane.

4. An imaging system as claimed in Claim 3 wherein said detection arm having a first condenser lens therein, said detector being located behind said first condenser lens.

5. An imaging system as claimed in Claim 4 wherein there is a beamsplitter located between said object and said detection arm, said beamsplitter directing light returning from said object into said detection arm.

6. An imaging system as claimed in Claim 5 wherein said beamsplitter is connected to de-scan said beam.

7. An imaging system as claimed in any one of Claims 1, 2, or 4 wherein the scan lens is a telecentric f*theta liquid-immersion scan lens.

8. An imaging system as claimed in any one of Claims 1, 2, and 4 wherein said detector is a spectrally-resolved detector.

9. An imaging system as claimed in any one of Claims 1, 2, or 4 wherein there are means for supporting said object to be observed and measured.

10. An imaging system as claimed in any one of Claims 1, 2, or 4 including a second condenser lens and a transmission detector placed on an opposite side of said object, said condenser lens and said transmission detector being coaxial with said scan lens, whereby light transmitted through said specimen is detected.

11. An imaging system as claimed in any one of Claims 1, 2, or 4 wherein said illumination source is a laser.

12. An imaging system as claimed in any one of Claims 1, 3, or 4 wherein a laser rejection filter is placed in front of said detector, said imaging system being a multiphoton or two photon imaging system wherein said illumination source is a short pulse laser to

excite multiphoton or two photon fluorescence respectively in said specimen, said laser rejection filter filtering out a signal from said laser, said immersion liquid increasing a numerical aperture of said liquid-immersion scan lens, thereby increasing an intensity of light at a focal point of said lens and improving multiphoton or two photon absorption respectively.

13. An imaging system as claimed in any one of Claims 1, 2 or 4 wherein there is a sidewall surrounding said scan lens, said sidewall extending between said scan lens and said object, said sidewall having a substantial sealing relationship with said scan lens and said object to retain said immersion liquid of said liquid-immersion scan lens between said scan lens and said object.

14. An imaging system as claimed in Claim 1, said imaging system being a real-time imaging system, there being a rotating Nipkow disk located between said illumination source and said object, said Nipkow disk producing a plurality of expanding beams moving toward said object, there being a focusing lens rigidly mounted a distance equal to a focal length of said focusing lens above an entrance pupil of said scan lens, said focusing lens also being a distance equal to a focal length of said focusing lens below said Nipkow disk, said focusing lens and said scan lens in combination focusing said expanding beams to diffraction-limited configurations in a prescribed object plane, said light from said object plane returning through said Nipkow disk with means for focusing said light returning through said Nipkow disk to produce a real image, said detector detecting said image.

15. An imaging system as claimed in Claim 14 wherein said focal plane array is a charged coupled array.

16. An imaging system as claimed in Claim 14 wherein said imaging system is a real-time scanning optical macroscope.

17. An imaging system as claimed in Claim 14 wherein said liquid-immersion scan lens is a telecentric f*theta liquid-immersion scan lens.

18. An imaging system as claimed in any one of Claims 1, 2, 4 or 14 wherein a part of the scan lens closest to the object is spring mounted.

19. An imaging system as claimed in any one of Claims 1, 2, 4 or 14 wherein said diffraction-limited configuration is one of a spot and a line.

20. An imaging system as claimed in any one of Claims 1, 2, 4 or 14 wherein said immersion liquid is one of water and oil.

21. A liquid immersion scan lens comprising a scan lens for use with an object, said scan lens having an external entrance pupil for focusing light on said object in a prescribed object plane, said scan lens having an immersion liquid filling a space between said scan lens and said object.

22. A method of constructing a scanning beam optical imaging system for macroscopic imaging of an object, said system having an illumination source producing a light beam directed upon an optical path toward said object, a scanner for scanning the light beam, a detector located to receive light from said object plane a display to produce a signal from said detector, said method comprising inserting a scan lens having an external entrance pupil for focusing said light beam to a defraction-limited configuration in a prescribed object plane and scanning said light beam using said scanner to move the defraction-limited spot in a predetermined scan pattern on said object plane.

23. A method of constructing a multi-photon or two photon scanning beam optical imaging system for a macroscopic object, said system having a short pulse labor source producing a light

beam directed along an optical path toward said object, a scanner for scanning said light beam, a detector located to receive light from said object plane and a display to produce a signal from said detector, said method comprising inserting a liquid-immersion scan lens for focusing said light beam to a defraction-limited configuration in a prescribed object plane without forming an image plane between said scan lens and said object plane and scanning said light beam using the scanner to remove said defraction-limited configuration in a predetermined scan pattern on said object plane.